

## SIMPLIFIED TRUCK TRACTOR SOCKET WIRING

### 5 CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. provisional patent application No. 60/439,933 filed January 14, 2003.

### 10 FIELD OF THE INVENTION

This invention pertains to electrical connections between heavy duty truck tractors and trailers connected to such tractors. More particularly, this invention pertains to a switching unit located in the tractor, preferably in close proximity to an electrical connection socket mounted in a rear portion of a heavy duty truck tractor, which is effective to apply  
15 electrical power from the tractor battery to a socket terminal when that terminal is to be energized to supply a voltage at the terminal.

### BACKGROUND OF THE INVENTION

The general specifications for the number of electrical conductors between heavy duty truck tractors and trailers operated in the United States and Canada long have been governed  
20 by Society of Automotive Engineers (SAE) Standard J560 ("SAE J560"), the current version of which is incorporated herein by reference. SAE J560 also governs the arrangement and sizing of terminals of connectors (plugs and sockets) for tractor-trailer electrical connections, and also the basic geometries of those connectors. The objective of SAE J560 is to assure the  
25 electrical interconnectability, without the use of adapters, of any truck trailer to any truck tractor. Other SAE standards address that interconnectability objective in the context of mechanical and pneumatic connections between truck tractors and trailers. In other parts of the world, standards having the same objective, but different specifics, are applicable.

30 The SAE J560 connectors used to make electrical connections between truck tractors and trailers are sockets and plugs. The sockets most commonly are mounted to the opposing faces of tractors and trailers. The plugs are carried at the opposite ends of tractor-trailer interconnection cables. Sockets typically are mounted in holes formed in the rear walls of tractor cabs and in the front end walls of trailers, so that a portion of the socket is outside the  
35 vehicle and a portion of the socket is inside the vehicle. Generally, the front of the socket is

outside the vehicle and the rear or back of the socket is inside the vehicle.

5      In tractors currently produced, the electrical connections to a mounted SAE J560 socket are complex and involved. Those connections typically are made by use of one or more multi conductor harnesses, one end of which can be a socket that mates with the terminals extending from the rear of the mounted J560 socket. The harness conductors extend from that harness end socket to various places in the tractor, such as to the battery, and to function switches and controllers, which in turn are connected to the battery. Some of these harness conductors are part of extensive circuits which include long conductors and many connectors. The result is that the power applied to the SAE J560 socket terminals frequently has a voltage less than the desired full battery voltage. The problem of low SAE J560 tractor socket terminal voltage is a problem shared by tractor manufacturers.

15      **SUMMARY OF THE INVENTION**

20      This invention addresses the problem of low tractor socket terminal voltage, and particularly low terminal voltage due to extensive circuitry within the tractor. This problem is addressed by providing an improved arrangement for providing power to the terminals of a tractor SAE J560 socket, for example. The new arrangement includes a power distribution unit in the form of a switching controller to which direct battery connections can be made and to which the terminals on the interior portion of a J560 socket can be directly connected. The controller includes a relay for each of the six functional (non-common) signal terminals of the J560 socket. Each relay has input and output power connections to which the battery and the respective J560 socket terminal can be connected. Command signals for operating those  
25      relays can be obtained from two sources. Relay command or control signals can be obtained from switches or controllers located elsewhere in the tractor, such as a trailer running light ON/OFF switch on the tractor dashboard. Relay control signals can also be obtained for some or all of the relays from a multiplex signal bus if such a bus is available and is used in the tractor. As the contacts of each relay are closed, full battery power is supplied from the  
30      relay output power connection to the relevant signal terminal of a J560 socket mated to or otherwise connected to the controller. The relay control signals can be low voltage signals compared to full battery voltage.

35      As a result, the internal wiring of a tractor can be greatly simplified. The power connections to the switching controller are provided by positive and negative conductors directly from the battery. If a tractor manufacturer elects to mount plural SAE J560 sockets

to a tractor, each such socket can be, and preferably is, associated with its own switching controller according to this invention.

5            The present invention relates to a power distribution unit useful in a truck tractor to apply electrical power to a selected one or more of a plurality of signal terminals of a tractor-mounted connector in a tractor-to-trailer electrical connection. The power distribution unit can comprise a power bus adapted for connection to a power source and an output terminal corresponding to each signal terminal of the connector. Further, the power distribution unit  
10          may also comprise a switch connected between each output terminal and the power bus, and an actuator associated with each switch, the actuator being operable upon receipt of a respective control signal to operate the associated switch.

#### BRIEF DESCRIPTION OF THE DRAWINGS

15          The above-mentioned and other aspects of the invention are set forth in greater detail in the accompanying drawings of presently preferred and other embodiments or implementations of the invention, and in which:

Fig. 1 is a schematic view of electrical wires connected between a truck tractor and a trailer;

20          Fig. 2 is a circuit diagram of an embodiment of the present invention showing a power distribution unit and accompanying socket;

Fig. 3 is a block diagram of an embodiment of the present invention including a multiplex decoder;

Fig. 4 is a schematic view of another embodiment of the present invention; and

25          Fig. 5 is a schematic view of a further embodiment of the present invention.

#### DETAILED DESCRIPTION

The present invention relates to an improved arrangement for providing power to the terminals of a truck tractor socket which preferably conforms to SAE J560 or another  
30          applicable standard. As shown in FIG. 1, a tractor **10** may be in electrical communication with a trailer **12** by means of a cable **14** connecting the tractor to the trailer. As noted above, the cable **14** may include multiple connectors connected to respective terminals of plugs **33** at each end of the cable. The plugs **33** are matable in sockets **32** mounted, preferably, in openings in the opposing faces of the tractor **12** and the trailer **14**. If, as preferred, the  
35          sockets **32** conform to SAE J560, plugs **33** also should conform to that standard.

A power distribution unit **20** of the present invention, as shown schematically in FIG. 5, comprises a housing **21** which includes a power bus **22** adapted for connection to a power source **24**. The power source **24** may be a battery, but the power source may also be any other acceptable means of supplying an adequate amount of power of the desired kind, preferably DC power. The power distribution unit **20** may further comprise at least one output terminal **26** and a corresponding switch **28**. In a preferred arrangement, the power distribution unit **20** may include one output terminal **26** and accompanying switch **28** corresponding to each signal terminal of the socket **32**. Additionally, the power distribution unit may comprise an actuator **30** associated with each switch **28**. In one arrangement, the actuator **30** may be a coil of a relay solenoid. In another arrangement, each switch **28** and associated actuator **30** together may comprise a relay operable by a respective command or control signal. Together, the switch and actuator combinations form a bank of relays **40** (FIG. 4). Each relay **40** can be an electromechanical device including a solenoid having a coil to which a command signal is applied. More preferably, however, each relay is a solid state electronic device having the equivalent of a coil.

As an example, a J560 socket includes seven terminals. Six of these terminals have functionalities assigned to them by SAE J560. Those six terminals can be said to be socket signal terminals, as opposed to the seventh terminal, which is a common terminal provided as a return path to electrical ground in the tractor (e.g., the tractor battery negative terminal) from the several trailer circuits to which power is supplied via the socket signal terminals.

The power distribution unit **20** operates as follows, as shown schematically in FIG. 3. A control signal may enter the power distribution unit **20** relay bank from a remote location on the tractor, such as when a driver applies a brake or activates a turn signal. When the control signal reaches the corresponding actuator **30** (FIG. 5), the actuator activates the corresponding switch **28**. Activation of the switch **28** closes the circuit between the power bus **22** and the corresponding output terminal **26** of the unit **20**, allowing power from the power source to be supplied directly to the desired output terminal. Additionally, the relay bank **40** may send back a status signal to the signal origin (FIG. 3).

FIG. 2 shows a schematic view of function control circuits **41** which are connected to a power source **44**, for example, a battery. When an operator triggers a function control switch **42**, a control signal is delivered along a signal control line **46** to the power distribution unit **20** described above. It will be appreciated that the length of the control signal lines **46** may be quite extensive and the interruption of the lines in the figure is meant to convey the

indefinite length of the lines. FIG. 2 further shows that part of the socket 32 may be located on the interior of the tractor wall 48 and part of the socket may be located on the exterior of the tractor wall.

As shown in FIG. 4, the power distribution unit 20 may be directly connected to the socket 32 if the terminals of unit 20 are defined as terminals of a unit connector 36 configured to be matable with the ends of the terminals of socket 32 which are inside the tractor when the socket is mounted to the tractor, i.e., the rear end of the socket. SAE J560 does not pertain to the rear (inside the tractor) aspects of a socket conforming to that standard. Therefore, the structure of unit connector 36 can be defined as desired consistent with the rear end structure of socket 32. Unit connector 36 can be mounted or affixed to a circuit board to which relays 40 are mounted, so that unit 20 can be mechanically and electrically connected directly to socket 32 within the trailer. However, if desired, the terminal output ends may be connected to the socket by any appropriate means, such as wiring.

As further shown in FIG. 4, multiplex modulation/demodulation (MUX/DEMUX) circuitry 38 may be mounted onto or in the power distribution unit 20. This circuitry 38 allows multiple unit command signals to be transmitted to unit 20 along a single line and may be used, for example, if there is a large distance between the signal origin and the power distribution unit 20.

A harness end connector can be replaced by a switching controller (power distribution unit) as described above and as shown more fully in the block, schematic and board layout drawings described above. The electrical connections to the controllers are simple and easier to manipulate than the harness cable (see FIG. 3) now commonly used.

The overall dimensions of the housing for the switching controller can be on the order of about 8.5 inches by 5.5 inches by 1.5 inches. The relays of the controller preferably are solid state relays mounted on a circuit board to which a seven-terminal female connector receptacle (matable with the terminals exposed on the interior portion of a J560 socket) also can be mounted. Multiplex modulation/demodulation (MUX/DEMUX) circuitry also can be mounted on that circuit board in association with an externally accessible connection to a multiplex signal bus. A separate control signal input terminal for each relay also may be accessible at the exterior of the controller housing.